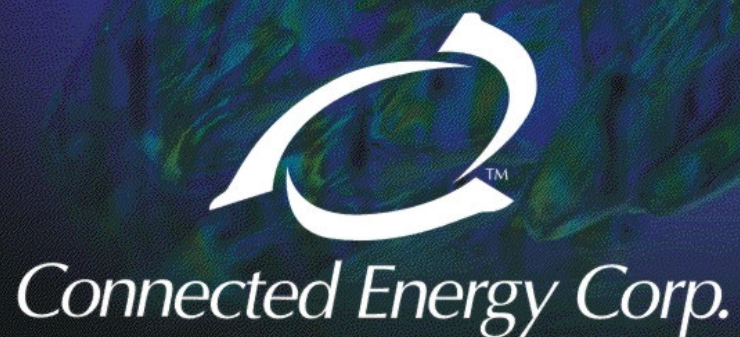




# Project Briefing



Advanced  
Communication  
and Control  
Project

October 29, 2003  
San Diego, CA

# ACCP Project Objectives

- Design and Proof-of-Design demonstration of an integrated DER Communication and Control System capable of delivering
  - Seamless integration of DER units at Aggregation Level that also meet individual user's facility needs.
  - Indifferent to DER deployments (Residential, Commercial or Industrial facilities), DER units are capable of being operated as resource options for Electric and Gas Utilities.

# Project Team

## **TEAM LEADER: Connected Energy**

### **California**

- SCE- demonstration site
- CAISO

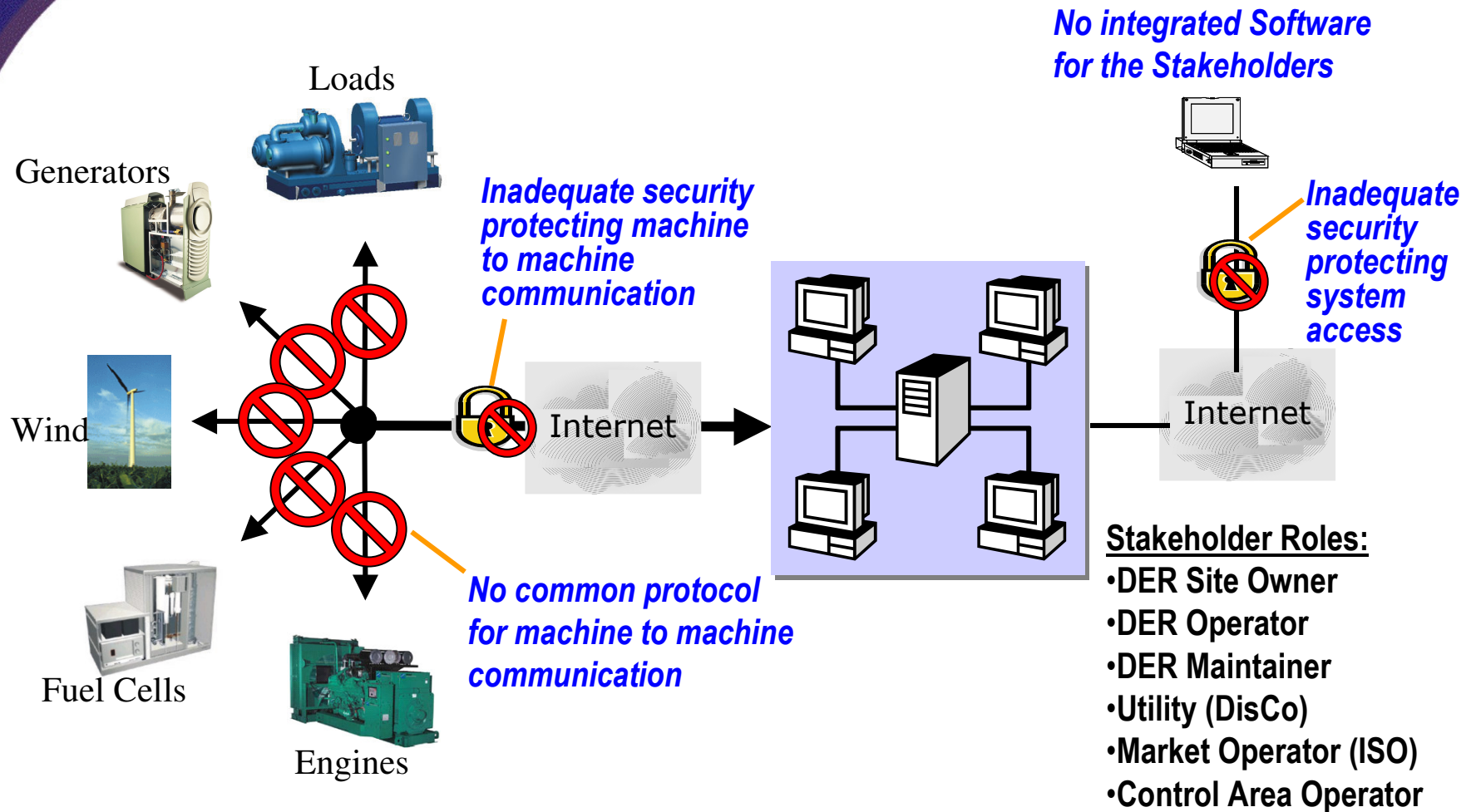
### **New York**

- Long Island Power Authority - demonstration site
- NYISO
- NY State Energy Research Development Authority - demonstration sites (2)

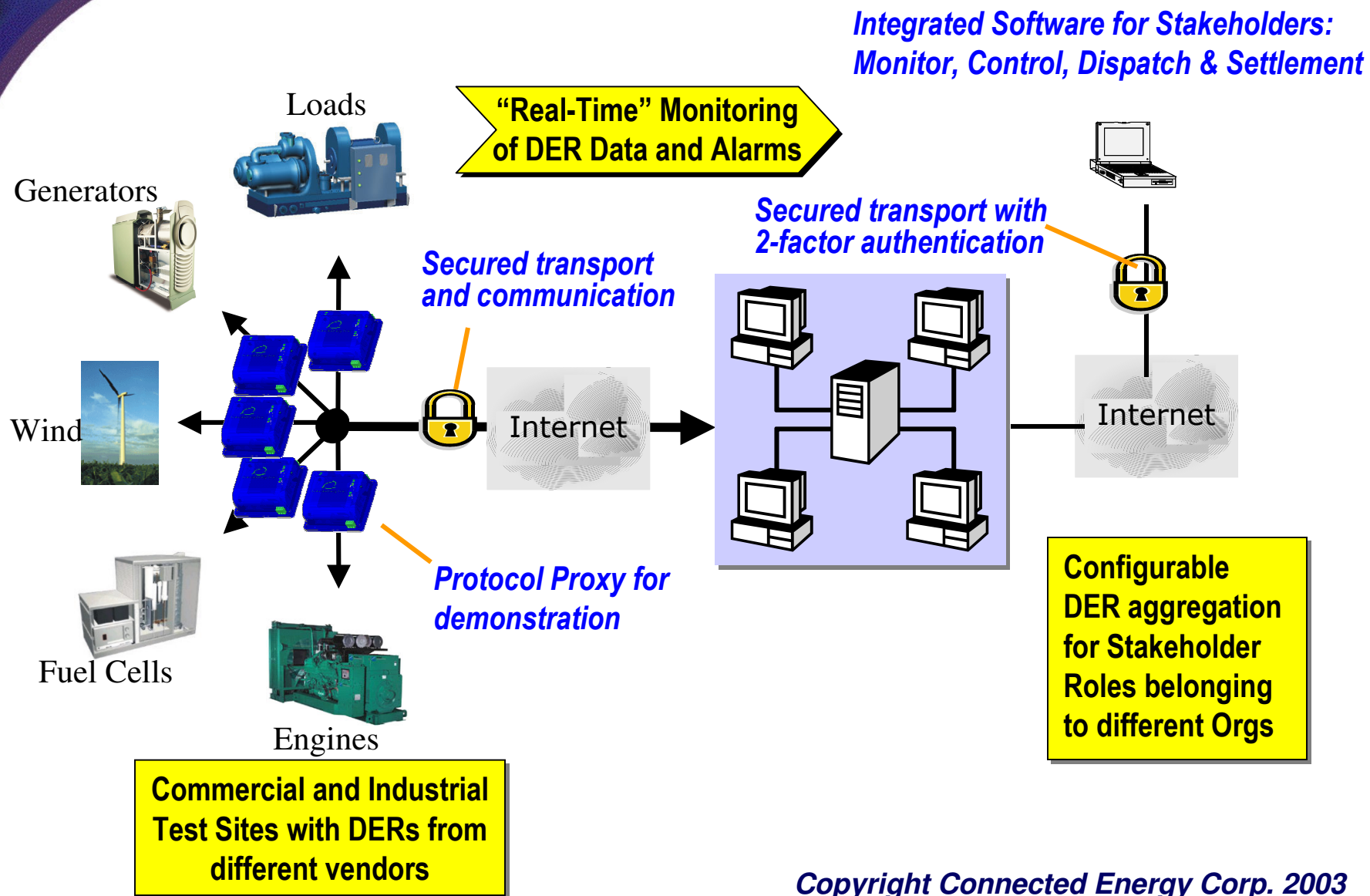
### **Other Participants**

- Sandia National Laboratory- Information and SCADA security
- Mykotronx- Cryptography and Cypher modules
- Gas Technology Institute- AGA Security Standard

# Current Situation



# Project Deliverables



# Schedule and Budget Overview

- Phase 1 is 6 months. Major tasks:
  - Document Stakeholder requirements as Use-Cases and define Project Security Policy
  - Design and Implementation of Protocol Framework and Software (enerVIEW) extensions
  - Provision Proof-of-Design Test Sites (4)
  - Test and Validation
  - Document Report and Phase 2 Proposal
- Phase 1 Budget:
  - Total approved: \$940,978
  - DOE award: \$299,458



## How will this Project Contribute to DOE's Vision?

- Demonstrate a practical Protocol and Software design aggregating the distributed management of DERs (load and generation).
- The design will expose real-world technical, security and pragmatic issues involved in achieving DOE's vision.
- The system will serve as the underpinning for future energy business software.
- Proof-of-Design demonstration allows meaningful comparison of alternative approaches:
  - SCADA based – traditional Control Systems approach.
  - IEC 61850 UCA – a comprehensive standard prescribing an "Architecture" including Object Models, Services and Protocols.
  - In-house developed systems at ESCos and Aggregators.

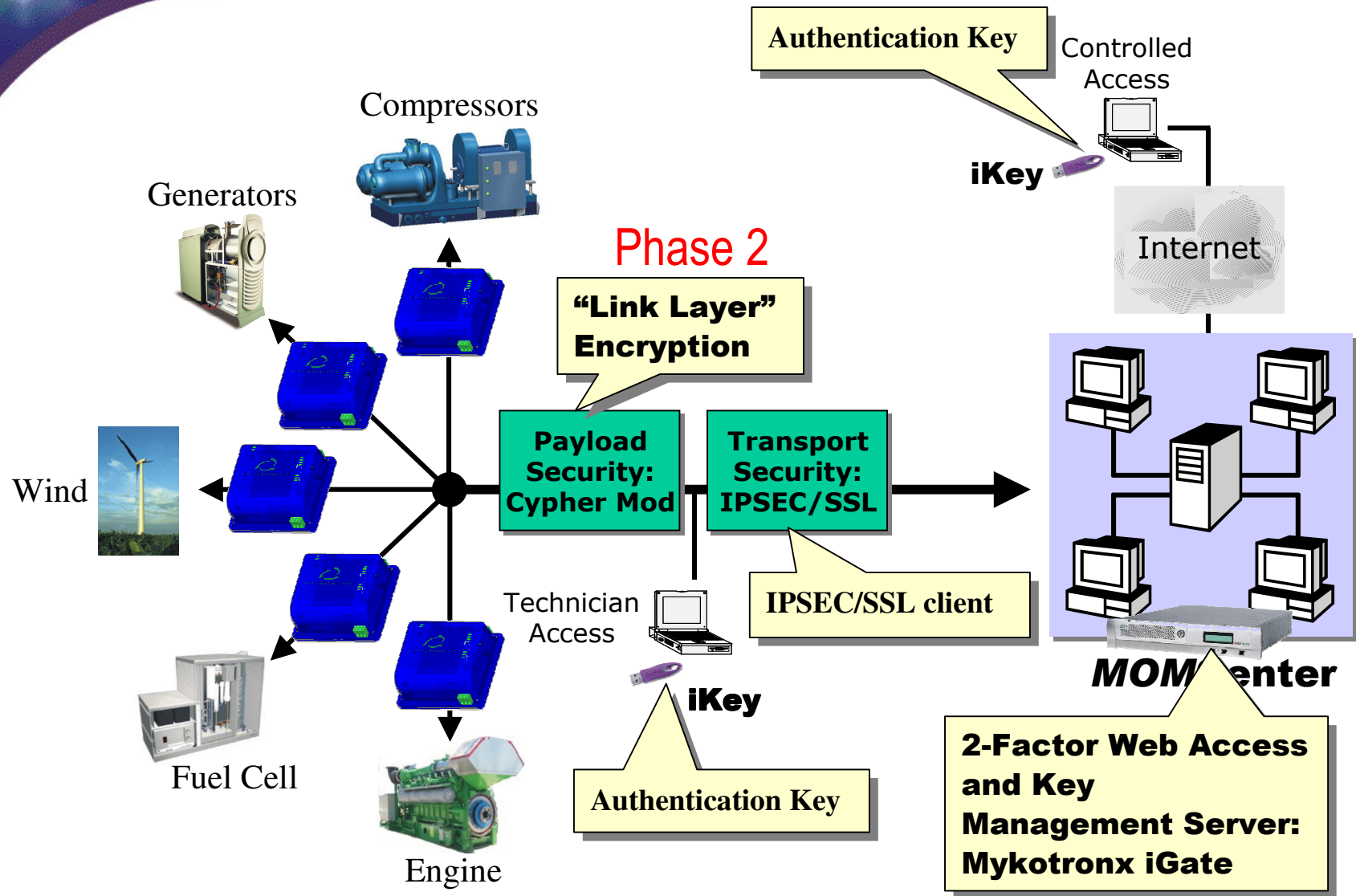
# Protocol Attributes

- Purpose is to facilitate and foster DER interoperability
- Deliver DER “Object Model” as payload.
- Protocol need to monitor the monitoring system.
- Protocol need to support multi-organizational DER aggregation.
- Protocol need to enforce secured aggregation.
- Protocol elements:
  - “Object Model” is an abstraction of the DER device
  - Handshake, transfer validation, flow control and exception handling
  - Data and data validation for early error recognition
  - Discovery of Protocol nodes and Protocol compatibility

# Software Attributes

- Allow Stakeholders to remotely Monitor, Control and Dispatch Loads and Generation in real-time.
- Log control and dispatch events according to Market and Demand-Response Signals for settlement.
- Web “any where” access without dedicated Client Software.
- Fine grain permissible entities to partition rights to DERs and DER sites.
- Two-factored authentication to protect system access.
- Visual User Interface for ease of use.

# Securing the System



# Progress Summary

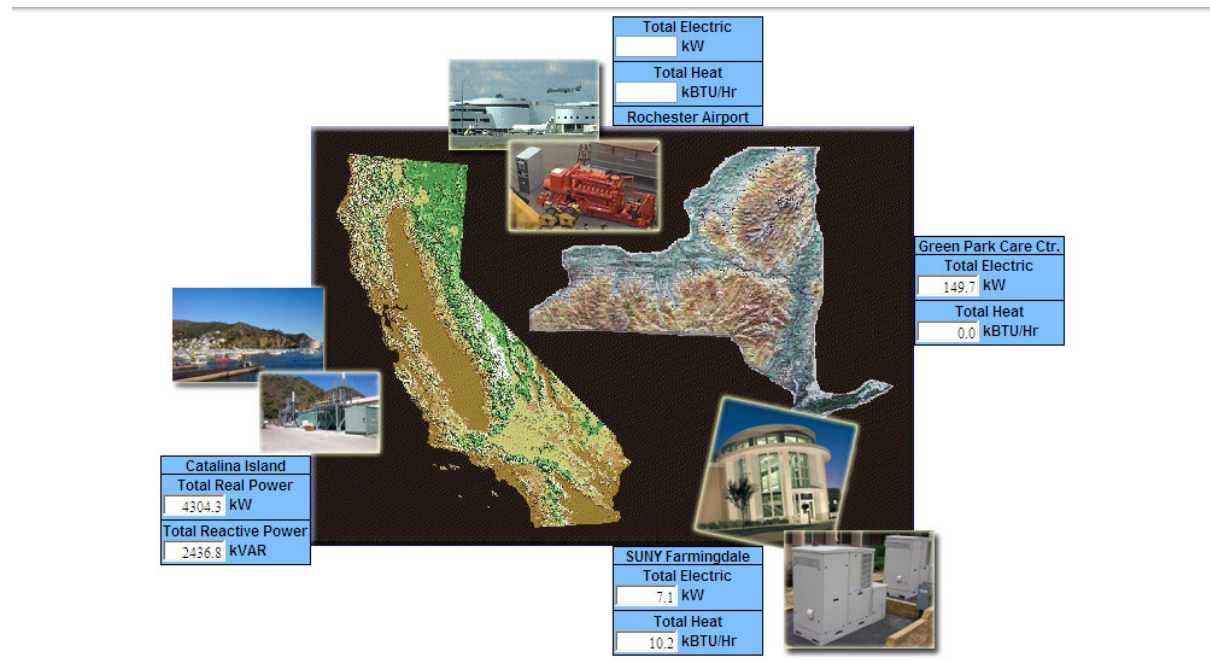
- Completed Stakeholder requirement gathering:
  - Defined Phase 1 functionalities
  - Use-Cases document distilled from Project's functionalities and Stakeholder requirements
  - 1st draft of Project's Security Policy
- Completed initial software design:
  - Version 1 of Software Design Document
  - Begin documenting Protocol requirements
- Provisioned 3 out of 4 proof-of-design sites.
- Prototype software extensions:
  - Integrated 2-factor user authentication function
  - Provisioned Internet accessible real-time monitoring for the 3 provisioned proof-of-design sites at <https://doe.enerstage.com>.

# Next Steps

- **Proof-of-Design Test Sites:**
  - Provision Greater Rochester Airport
  - Provision Captione C60 60kW MTG on Catalina's
  - Implement remote Generator control.
- **Software and Protocol Development:**
  - Complete enerTALK protocol extension specification.
  - Complete design and implementation of dispatching demand-response and market pricing signals
- **System test and validation at test sites:**
  - Review security design against Security Policy
  - Exercise prototype system according to test plan.
  - Evaluate implementation with preliminary E2I ADA/DER Object Model
  - Evaluate implementation with preliminary IEEE 1547.3 Monitor Data Set
  - Compare design against alternative approaches
- **Phase 2 Proposal and Phase 1 Final Report**

# Four (4) Proof-of-Design Sites

- **ONLINE** State University of New York (SUNY), Farmingdale Campus, Farmingdale, NY
  - LIPA Site
- **ONLINE** Greenpark Care Center, Brooklyn, NY
  - NYSERDA Site
- Pebble Beach Generating Station, Catalina Island, California **ONLINE**
  - Southern California Edison Site
- Greater Rochester International Airport, Rochester, NY
  - NYSERDA Site



# Aggregated View



Advanced  
Communication  
and Control  
Project

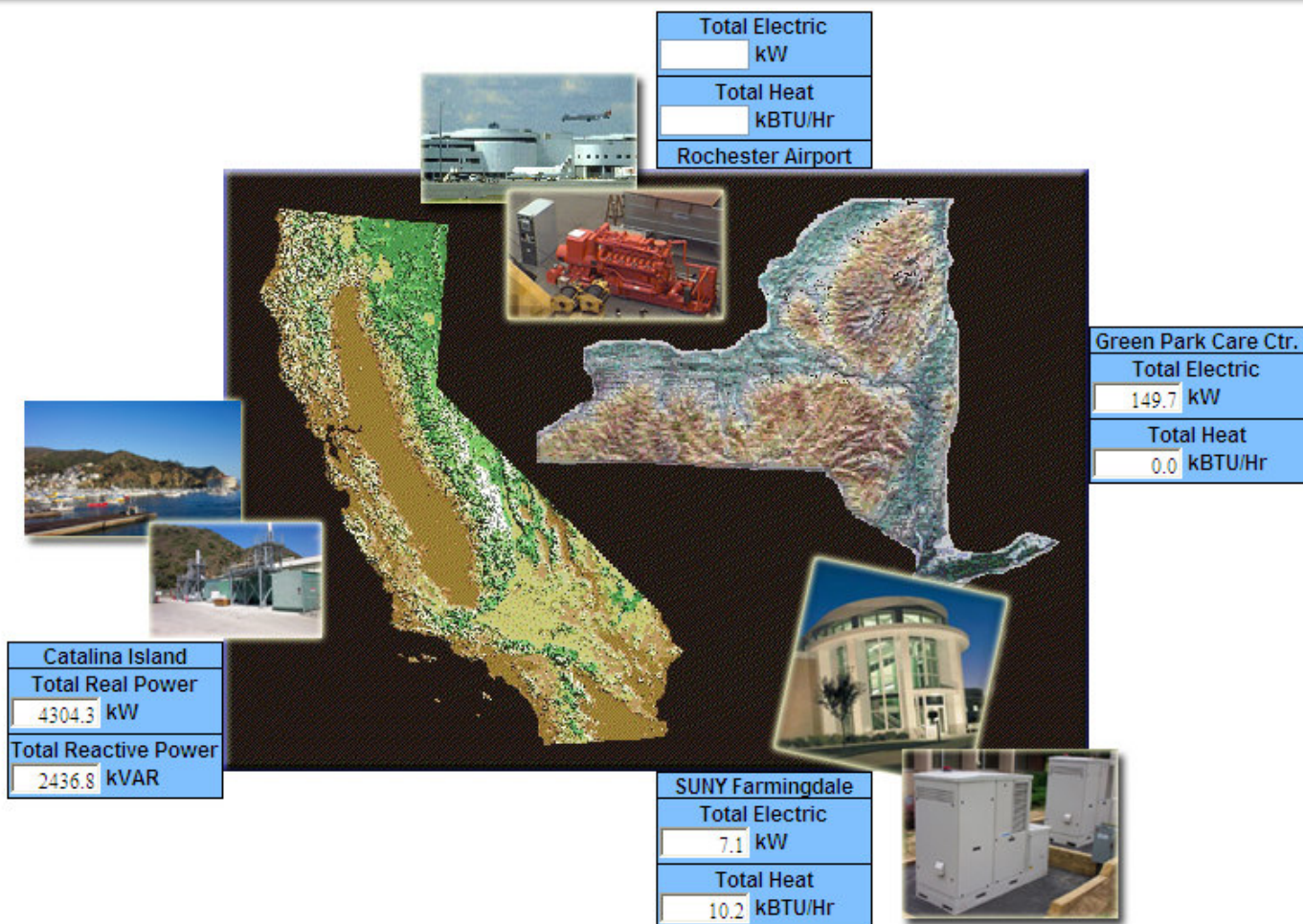
Go To

Go Do

Help

Welcome: CEC DOE Administrator

Powered By:  
Connected Energy Corp.



# Test Site Overview Screens

**DOE CEC** Advanced Communication and Control Project Go To Go Do Help Welcome: CEC DOE Administrator Powered By: Connected Energy Corp.

Station Total Current	1184.3 Amps
Station Avg. Voltage	2408.2 KV
Station Total Power	4381.5 KW
Stat. Tot. React. Pwr.	2436.9 KVAR
Station Avg. Freq.	59.00 Hz
Data Updated	14:50 on 10/26/2003

Daily Max	4474.1 KW
	2524.3 KVAR

Daily Total	41567 KWh
	24072 KVARh



**DOE CEC** Advanced Communication and Control Project Go To Go Do Help Welcome: CEC DOE Administrator Powered By: Connected Energy Corp.

Site Power	7.7 KW
Site Mthly. Pk. Pwr.	8.6 KW
Site Gas Usage	2.6 SCFM

Fuel Cell Power	2.7 KW
Fuel Cell Gas Flow	19.5 SLM

Fuel Cell Power	2.6 KW
Fuel Cell Gas Flow	33.0 SLM

Fuel Cell Power	2.6 KW
Fuel Cell Gas Flow	21.4 SLM

Site Cum. Elec. Prod.	22827.7 KWh
Site Cum. Gas Usg.	32.9 CCF
Site Cum. Heat Rec.	65908.0 KBTU
Local Time	14:53
Local Date	10/26/2003
Other Data Updated	14:52 on 10/26/2003

Main State	Run/Standby SS
Fuel Cell Fault	Run/Standby
FC1 Data Updated	14:53 on 10/26/2003

Main State	Run/Standby SS
Fuel Cell Fault	Run/Standby
FC 2 Data Updated	14:53 on 10/26/2003

Main State	Run/Standby SS
Fuel Cell Fault	Run/Standby
FC 3 Data Updated	14:53 on 10/26/2003

Site Heat Recovery	9.5 KBTU/Hr
	2.6 KW



**DOE CEC** Advanced Communication and Control Project Go To Go Do Help Welcome: CEC DOE Administrator Powered By: Connected Energy Corp.

Site Power Gen. (E)	150.2 KW
	0.0 KWh.MTD
	0.0 KWh.YTD
Site Heat Del. (M)	0.0 KBTU/Hr
	265.2 KBTU.MTD
	265.2 KBTU.YTD
Site Gas Usage (M)	0.0 SCFM
	CCF.MTD
	CCF.YTD

Unit 1 Power (E)	75.0 KW
Unit 1 Oper Mode (E)	Run
Unit 1 Alarm (E)	None
Unit 1 Pre-Alarm (E)	None

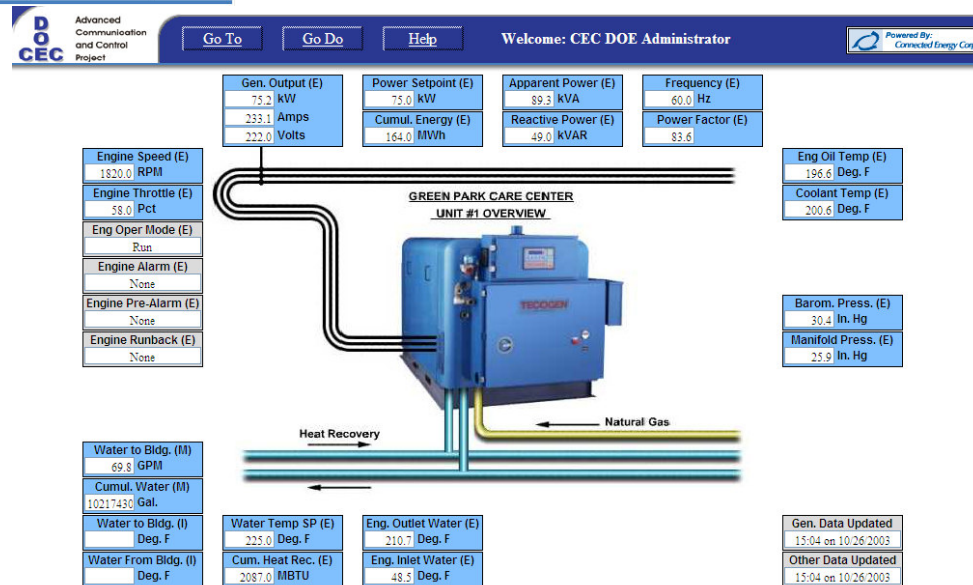
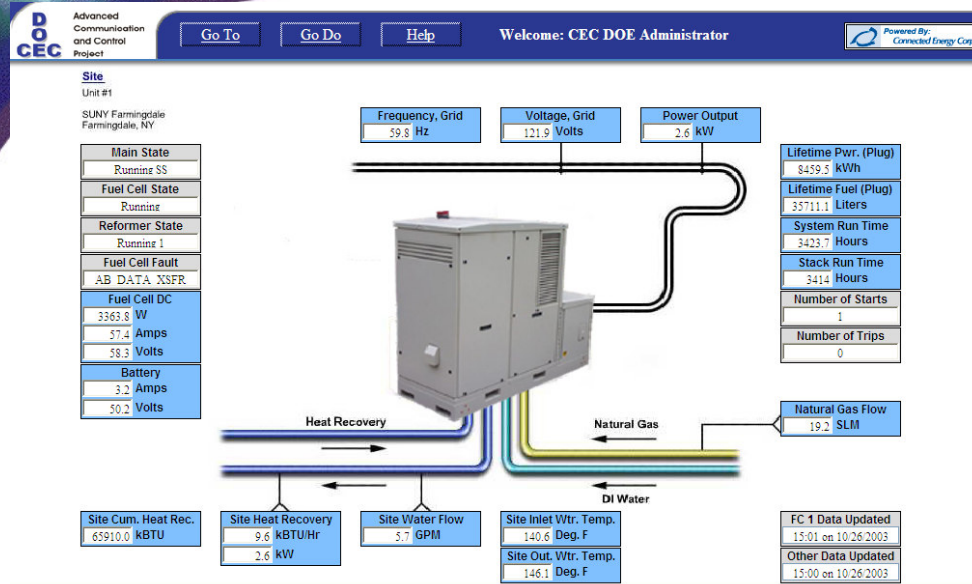
Unit 2 Power (E)	75.0 KW
Unit 2 Oper Mode (E)	Run
Unit 2 Alarm (E)	None
Unit 2 Pre-Alarm (E)	None

Site CHP Effic. (M)	%
Site Elect. Effic. (M)	%
Gen. Data Updated	15:03 on 10/26/2003
Other Data Updated	15:03 on 10/26/2003
Local Time	15:04
Local Date	10/26/2003

**Site Overview**  
Green Park Care Center  
Brooklyn, New York  
TECOGEN CM-75  
Cogeneration Modules  
(75 KW, 450 KBTU/Hr Each)



# Generator Overview Screens



Copyright Connected Energy Corp. 2003

# Generator Detail Screens

**DOE CEC**  
 Advanced Communication and Control Project

[Go To](#)
[Go Do](#)
[Help](#)

Welcome: CEC DOE Administrator

Powered By: Connected Energy Corp.

**Site**  
 Unit #1  
 SUNY Farmingdale  
 Farmingdale, NY

**System Efficiency**  
 25.6 %

**Power (kW)**  
 Total  
 L1  
 L2

**Current (Amps)**  
 8.6 L1  
 8.0 L2

**Voltage**  
 L1  
 L2

**Fuel Cell DC**  
 3410.5 W  
 Amps  
 58.3 Volts

**System Coolant Lvl.**  
  
**Stack Coolant Level**  
  
**Humidifier Level**  
 2.7 Volts  
**DI Water Tank Level**  
 %

**Battery**  
 Amps  
 Volts  
 Deg. F

**Reform. kW Equiv.**  
 10.5 kW

**Natural Gas Flow**  
 SLIM

**FC 1 Data Updated**  
 15:02 on 10/26/2003

Note: The data displayed on this screen is generated by the Plug Power fuel cell controller.

**DOE CEC**  
 Advanced Communication and Control Project

[Go To](#)
[Go Do](#)
[Help](#)

Welcome: CEC DOE Administrator

Powered By: Connected Energy Corp.

**Gen. Output (E)**  
 75.2 kW  
 234.5 Amps  
 222.0 Volts  
**Engine Speed (E)**  
 1820.0 RPM  
**Engine Throttle (E)**  
 58.0 Pct  
**Eng Oper Mode (E)**  
 Run  
**Eng Alarm (E)**  
 None  
**Eng Pre-Alarm (E)**  
 None  
**Eng Runback (E)**  
 None  
**O2 Sensor (E)**  
 109.0 mV  
**Catalyst Inlet (E)**  
 109.8 Deg. F  
**Catalyst Outlet (E)**  
 113.2 Deg. F  
**Lg Trm Blk Lrn (E)**  
 97.0  
**Sh Trm. Blk. Lrn (E)**  
 127.0  
**Emiss. Chk Eng (E)**  
 OFF

**Ph - Ph Voltages (E)**  
 220.5 1 - 3  
 219.9 2 - 3  
 224.8 1 - 2  
**Phase Currents (E)**  
 230.7 1, Amps  
 230.8 2, Amps  
 239.2 3, Amps  
**Apparent Power (E)**  
 89.3 kVA  
**Reactive Power (E)**  
 49.0 KVAR  
**Frequency (E)**  
 60.0 Hz  
**Power Factor (E)**  
 83.6  
**Voltage Angle 2-3 (E)**  
 61.4 Deg.  
**Voltage Angle 1-2 (E)**  
 64.2 Deg.  
**Current Ang. (E)**  
 298.9 1, Deg.  
 56.4 2, Deg.  
 177.7 3, Deg.  
**Barom. Press. (E)**  
 30.4 In HG  
**Manifold Press (E)**  
 25.9 In HG  
**Int. Voltages, mV (E)**  
 4958.0 Logic  
 11765.0 Analog  
 13584.0 Battery  
**Fuel Valve Pos (E)**  
 55.4 Pct  
**Total Starts (E)**  
 117.0  
**Total Oper Hrs (E)**  
 2324.0  
**Enclosure Temp (E)**  
 160.6 Deg. F  
**Gen. Data Updated**  
 15:05 on 10/26/2003  
**Other Data Updated**  
 15:05 on 10/26/2003

**GREEN PARK CARE CENTER  
UNIT #1 DETAIL VIEW**

**Press. Switches (E)**  
 OK Hi Water  
 OK Lo Water  
 OK Low Oil  
**Low Oil Level (E)**  
 OK  
**Ign. Pwr., Verify (E)**  
 ON  
**Eng Oil Temp (E)**  
 198.4 Deg. F  
**Coolant Temp (E)**  
 198.9 Deg. F

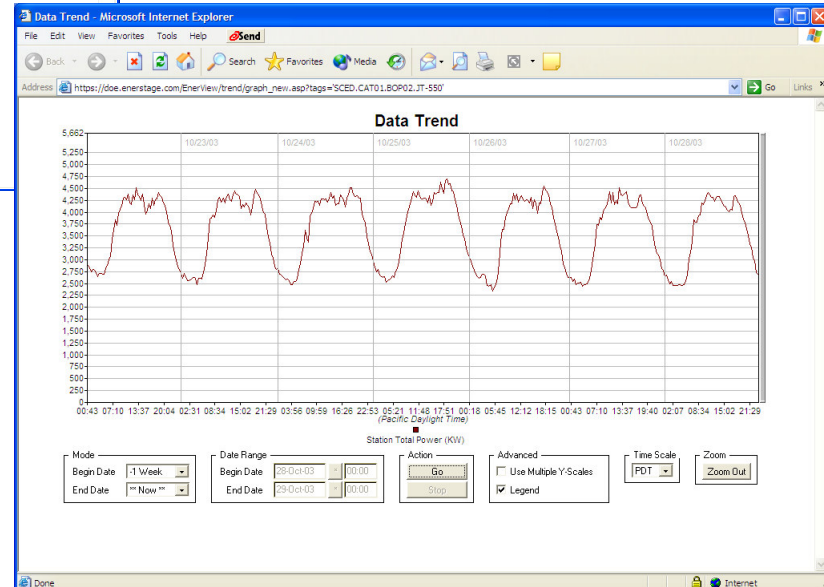
# Web Control and Trending

Connected Energy Control Console - Microsoft Internet Explorer

**MANUAL CONTROL CONSOLE**  
SITE: SUNY Farmingdale  
EQUIPMENT: Unit 1

REMOTE CONTROL	REMOTE STOP	EQUIPMENT STATE
<b>DEACTIVATE</b>		
POWER SETTING: <input type="text"/>	STOP: <input type="text"/>	POWER OUTPUT: N/A KW
<b>5.0 KW</b>	<b>STOP</b>	STATUS: No Status Available
<b>4.0 KW</b>		FAULT: No Fault Available
<b>2.5 KW</b>		Controls will deactivate in: 04:52

Scheduling is inactive in MANUAL Mode.



# Additional Functionalities

- Alarm Annunciator
- Alarm Management
- Dispatch Schedule Builder
- Role Administration
- User Administration
- Notification Administration



# Contact Information

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